PATENT SPECIFICATION

Convention Date (France): Dec. 28, 1938.

524,128

Application Date (in United Kingdom): Jan. 23, 1939. No. 2301/39.

Complete Specification Accepted: July 30, 1940.

COMPLETE SPECIFICATION

Improvements in and relating to Bearings

I, ETTORE BUGATTI, a subject of the King of Italy, of Molsheim, Bas-Rhin Department, France, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to bearings of the kind employed for rotatable members such as rotatable shafts of engines.

High bearing loads tend to be developed in modern engines, particularly in main crankshaft and connecting rod bearings of fast running Diesel engines and high-efficiency internal combustion engines. It is frequently found in practice that the conventional anti-friction liners are apt to fail due to hammering, breakage, loss of proper form, even, in some cases, eventually becoming detached from the shell of the bearing.

Various attempts have been made for improving the behaviour of bearings in use. The mere substitution of lead-bronze for tin as the main constituent for the liner has failed to give full satisfaction, as the permissible maximum pressure is not considerably increased. In so far as the use of anti-friction metal liners is concerned, it has been a common practice to provide a rough surface on the shell which backs or supports the liner, for instance by indenting, recessing or grooving said shell. Again it has been proposed to position in high relief on the said surface of the shell, when the latter is made of a hard metal, a plurality of spaced strips made of a soft metal. In either instance, the anti-friction metal is cast over the rough surface or its combination with the strips so as to form a continuous liner over the whole area. Should the liner happen to be worn out or to melt, the possibility of damage to the shaft is lessened when the shell is of relatively soft metal or is furnished with strips of soft metal, but the shaft rubs on such metal only under fortuitous circumstances as will be readily appreciated.

It is further known to provide the shell with series of suitable recesses, spaced apart from each other. The side walls of said recesses are bevelled to accommodate pads of antifriction metal; said pads substantially protrude from the shell inner surface and leave lubrication passages between them. If such pads are damaged, the shaft is not accurately maintained in the bearing, and, as it has been previously pointed out, the permissible maximum pressure is not considerably increased.

It has also been proposed to provide a bearing shell with drilled circular holes, or with grooves in which a white-metal is cast, the shell being then suitably machined so that the surface of the white-metal lies flush with the inner surface of the shell. In such an arrangement however the circular holes or said grooves are not provided close to each other, so that the shaft rubs on a substantial portion of the shell inner surface. This is an important drawback if the shaft is rotated at high speed or if the bearing is to support a considerable pressure, specially if the shell is formed of a hard metal such as steel.

A number of self-lubricating or "oilless" bearings have also been proposed with the object of simultaneously providing for lubrication and causing the lubricant to co-operate with the metal of the bearing to sustain the weights imposed by the shafts or like parts. The lubricant which is generally a compound containing graphite is positioned in pockets, recesses or cavities of various shapes or in grooves of spiral form, possibly intersecting to leave metal studs of diamond shape between them, the exposed surface of the lubricant being originally made to lie flush with that of the intervening metal of the bearing.

It is an object of this invention to provide an improved bearing for rotatable members, in which an anti-friction liner made of anti-friction metal, that is a material which (not being stricto sensu a lubricant, is not so readily swept away as is a true lubricant such as graphite) is so combined with the remainder of the bearing as to be strongly held against breakage and lateral displacement.

Another object is to provide a bearing improved as above set forth, wherein the

metal of the bearing portion which supports the liner is caused at any time to co-operate with the anti-friction metal of the liner to sustain the weight imposed by the corresponding rotatable members.

Further objects of the invention will become apparent as the specification proceeds.

It is to be appreciated that the term "anti-friction metal" as used throughout the specification and claims is employed in a broad sense to mean not only metal proper but also metal alloys, for instance tin alloys, lead-bronze and like anti-friction metal alloys which are known by those skilled in the art.

According to this invention, a bearing surface of the kind referred to for rotatable members has its effective surface composed of an anti-friction layer which is divided into a plurality of separate sections by thin ribs of metal which is harder than the anti-friction metal, the ribs being closely and regularly disposed throughout the bearing surface with the exposed surface of the ribs lying flush with that of the lining. Such an arrangement ensures sections of the anti-friction metal lining being nipped between stationary walls so as to be capable of withstanding loads which may be considerably greater than the maximum permissible load for an ordinary bearing provided with a continuous lining. Moreover such a bearing is less liable to work loose, even after a prolonged service, while lubrication is improved and oil losses are reduced.

The ensuing description taken with reference to the accompanying drawing which is given by way of a non-limitative example, will give a thorough understanding of how the invention can be carried out, the peculiarities which become apparent both from the drawing and from the text, of course, forming part of the invention.

Figure 1 is a side view of a half-bush of a bearing;

Figure 2 is a plan view of the same half-bush without the anti-friction lining;

Figure 3 is a partial axial section on a larger scale showing a bearing bush with the anti-friction lining in position;

Figures 4 to 6 correspond to Figure 3 and show in section modifications of arrangement and of shape of the anti-friction lining;

Figures 7 to 12 show, partially developed on a plane, various possible shapes of the partitioning at the sliding surface of the bush or adjacent said surface.

According to Figures 1 to 3, the bearing is intended to be formed by two semi-circular shells 1, for example made of bronze, provided with helical grooves 2, the threads of which lead at each end into two circular grooves 3.

After applying the anti-friction metal lining 4 to the bearing shell the bearing is machined or otherwise finished to provide a smooth bearing surface.

The width of the ribs or partitions 5 exposed at the actual bearing surface may be reduced to knife edge form as shown, for instance, in Figure 4.

The cross-section of the anti-friction metal elements 4 may be semi-circular (Figures 3 and 4) trapezoidal (Figure 5) or any other shape.

The ribs or partitions 5 may be arranged in any manner which ensures their being evenly disposed throughout the bearing metal, but the arrangement is preferably such that the ridges of the ribs do not bear continuously on any one spot of the journal. In this respect, the arrangement of the ribs longitudinally of the bearing axis (Figure 9) or, better, their oblique arrangement in helices (Figure 7) is preferable to the arrangement of the ribs transversely of the bearing axis (Figure 8). Similarly, checkering having directions which are oblique or parallel with the axis (Figures 11 and 12) is preferable to checkering involving transverse ribs (Figure 10), although any shapes may be adopted according to the particular circumstances, it being possible moreover for the anti-friction lining elements to be shaped like strips (Figures 2, 3, 7, 8, 9) squares or rectangles (Figure 10), lozenges (Figure 11), triangles (Figure 12), etc., provided that the said lining elements are disposed close to each other.

Said elements may be cast or applied by force into their housing, in a permanent manner; they may also be simply inserted therein in a removable manner.

Finally, Figure 6 shows a partial section of a bearing, the shell 1 of which is made of steel and which is provided with a bronze partitioning formed by strips of triangular cross-section which are helically wound and are fixed on the body 1 which in this case only performs the function of a high-tensile foundation. The anti-friction material 4 is applied between the strips 7 exactly as in the previous examples. The strips 7 may be replaced by a netting corresponding to a shape of the kind of that of Figures 10 to 12.

It is obvious that, without exceeding the scope of the invention, it is possible to make modifications in the embodiments which have just been described and

variously to combine the peculiarities of same.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A bearing surface of the kind referred to for rotatable members having its effective surface composed of an anti-friction layer which is divided into a plurality of separate sections by thin ribs of metal which is harder than the anti-friction metal, the ribs being closely and regularly disposed throughout the bearing surface with the exposed surface of the ribs lying flush with that of the lining.

2. A bearing as set forth in Claim 1, wherein the ribs are formed integral with the shell or equivalent member of the bearing.

3. A bearing as claimed in Claim 1, having the ribs formed separate from and secured to the bearing shell.

4. A bearing as claimed in any one of the foregoing claims, wherein a circular groove is provided at each end of the bearing.

5. A bearing as claimed in any one of the foregoing Claims 1 to 4, wherein the sections of the anti-friction metal lining are housed in grooves or recesses having a substantially semi-circular or trapezoidal cross-section.

6. A bearing as claimed in any one of the foregoing claims, wherein the ribs form a network running in two or more intersecting directions.

7. A bearing as claimed in any one of the foregoing claims wherein the ribs are disposed helically.

8. A bearing as claimed in any one of the foregoing claims, having sections of anti-friction metal lining provided in the form of removable pellets.

9. Bearing for rotatable members, constructed substantially as described with reference to the accompanying drawings.

Dated this 23rd day of January, 1939.

For the Applicant:
F. J. CLEVELAND & Co.,
Chartered Patent Agents,
29, Southampton Buildings,
Chancery Lane, London, W.C.2.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1940.

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1

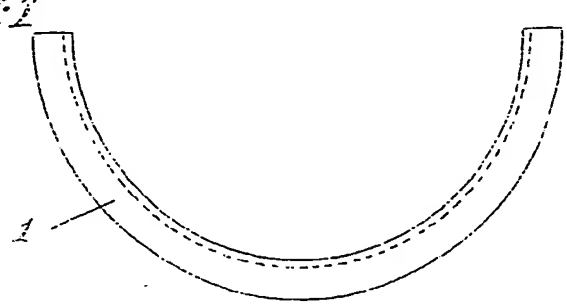


Fig. 2

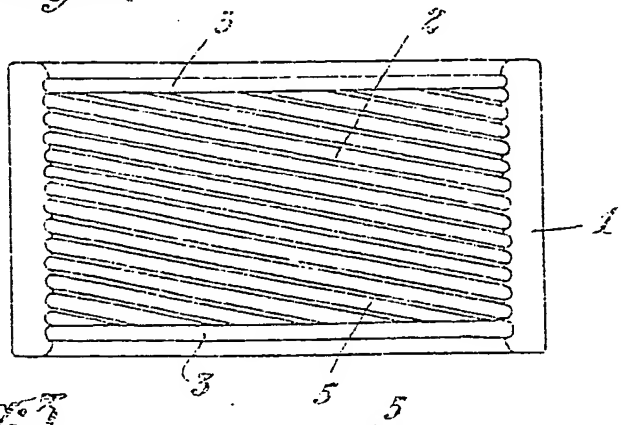


Fig. 3

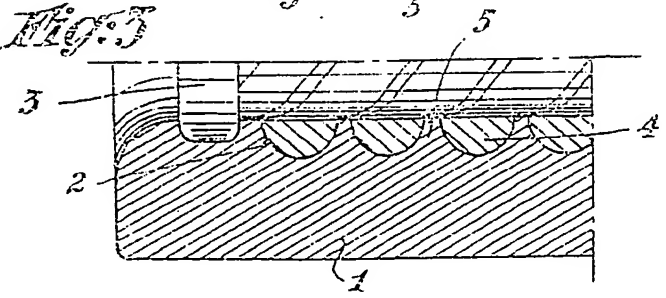


Fig. 4

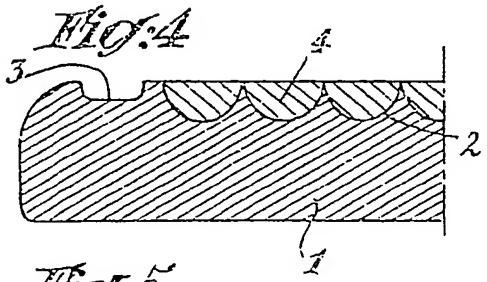


Fig. 5.

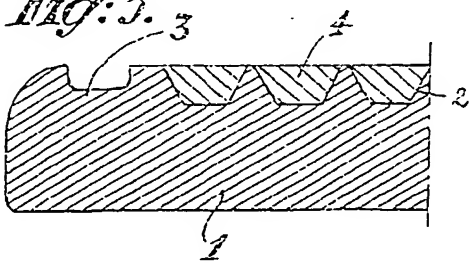
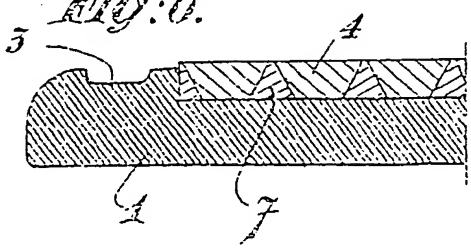


Fig. 6.



SHEET 1

Fig: 7.

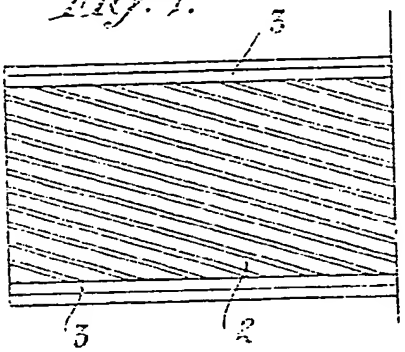


Fig: 8.

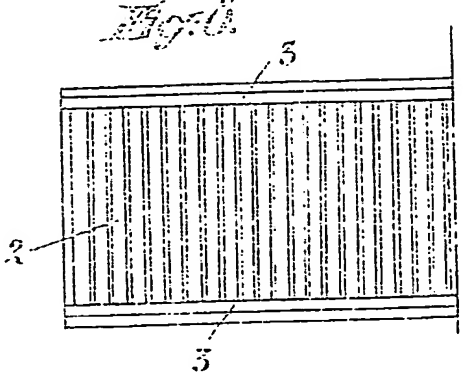


Fig: 9.

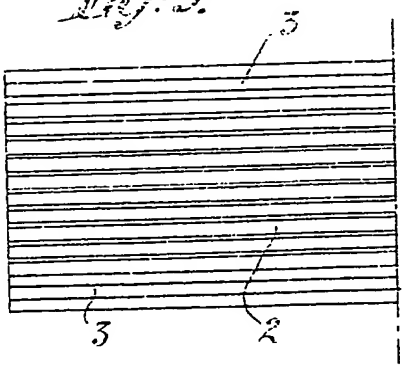


Fig: 10.

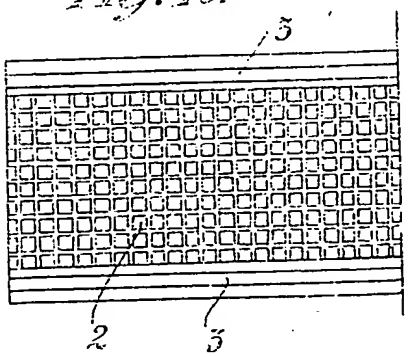


Fig: 11.

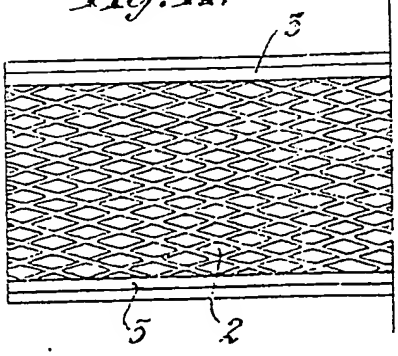
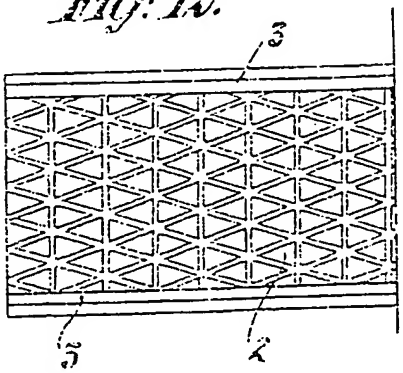
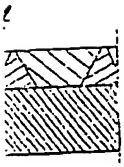


Fig: 12.





524,128 COMPLETE SPECIFICATION

SHEET 1

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

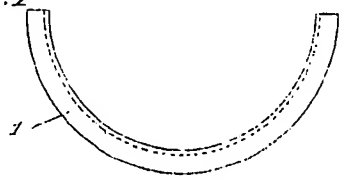


Fig. 2.

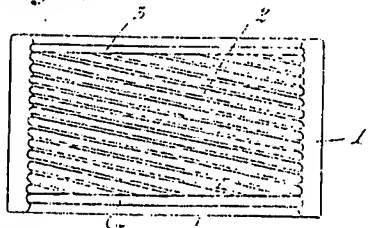


Fig. 3.

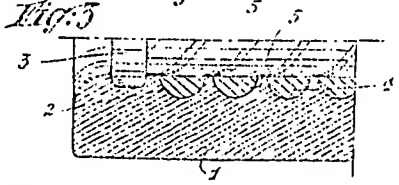


Fig. 4.

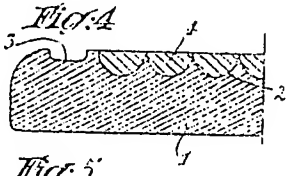


Fig. 5.

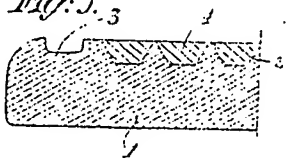


Fig. 6.

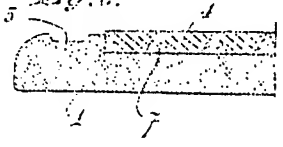


Fig. 7.

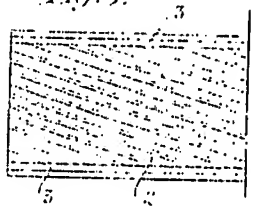


Fig. 8.

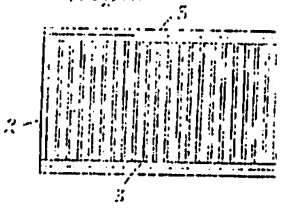


Fig. 9.

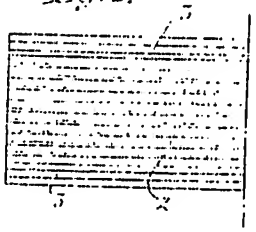


Fig. 10.

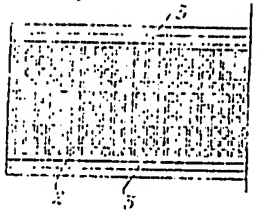


Fig. 11.

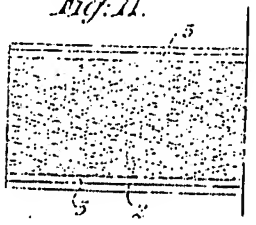


Fig. 12.